
GAO

Office of Information Management and
Communications

December 1991

Video Teleconferencing

GAO's Pilot Test





United States
General Accounting Office
Washington, D.C. 20548

**Office of Information Management
and Communications**

December 31, 1991

The Honorable George White, FAIA
Architect of the Capitol
Washington, DC 20515

Dear Mr. White:

This report presents our evaluation of the legislative branch-sponsored pilot test of using video teleconferencing (VTC) in the performance of GAO's mission. This 6-month pilot test between our headquarters and Seattle Regional Office has clearly demonstrated that this technology can benefit GAO's organizational effectiveness.

GAO plans to begin limited implementation of VTC in fiscal year 1992 by phasing in three more West Coast field offices to our network. We plan to use dial-up telecommunications service to provide the flexibility required to hold VTC sessions in a multisite environment at less cost than using dedicated lines. As we gain more experience and technology and cost trends evolve, we will assess which of our other field offices are the best candidates for expanding VTC service.

We appreciate your contribution to funding and acquiring the equipment and services used in the pilot test. We would be pleased to brief you and the Legislative Branch Telecommunications Network (LBTN) team on the results.

We are sending copies of the report to appropriate Senate and House Committees and other interested Members of Congress.

Sincerely yours,

A handwritten signature in cursive script that reads 'F. Kevin Boland'.

F. Kevin Boland
Director

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Abbreviations

AM	assignment manager
AOC	Architect of the Capitol
DMTAG	Design Methodology and Technical Assistance Group
EIC	evaluator-in-charge
HRD	Human Resources Division
IMTEC	Information Management and Technology Division
kbs	thousand bits per second
LBTN	Legislative Branch Telecommunications Network
OIMC	Office of Information Management and Communications
RCED	Resources, Community, and Economic Development Division
SES	Senior Executive Service
TAG	Technical Assistance Group
VTC	video teleconferencing

GAO's Pilot Test of Video Teleconferencing

Background

As the volume and complexity of issues facing the nation continue to increase, the Congress—now, more than ever—needs timely, objective, and accurate information. This environment creates significant challenges for GAO. The increased number of congressional requests has not only added to GAO's work load, but the increasing complexity of these issues calls for more direct interaction among senior managers; specialists (such as economists, attorneys, and computer analysts); and the assignment team; as well as more interaction with congressional staffs.

GAO's experience has shown that prompt coordination and communication are critical to the quality and timeliness of its products. For example, assignment teams, whose members are usually geographically dispersed, must coordinate with one another and reach agreement on a number of points, such as defining objectives and a work plan, determining the type and delivery date of planned products, and developing the report message. Timely consultation with Hill customers during an assignment is also essential.

Face-to-face meetings are necessary throughout an assignment because documents must be presented and analyzed, multiple views and expert opinions synthesized, evidence weighed, conclusions documented, and recommendations developed. Because conducting these functions effectively by telephone is nearly impossible, GAO has been testing new video teleconferencing (VTC) technology to assess its potential in helping GAO maintain high job quality standards in times of increasing work load and extremely tight budgets.

VTC technology is now appropriate for GAO because recent advances have reduced its cost and improved the quality of communication. For example, a few years ago VTC required very costly direct access to satellites. Today, good quality video communication can be obtained over telephone lines at a fraction of the previous cost. The ability of VTC to help groups communicate quickly and effectively in a face-to-face environment offers great potential for improving the efficiency and the effectiveness of GAO's work.

Purpose of the VTC Pilot Test

To test the feasibility of using VTC, GAO and the Architect of the Capitol (AOC) agreed to conduct a 6-month pilot test, and the Congress authorized this test as part of the fiscal year 1990 legislative branch appropriations. GAO's Office of Information Management and Communications (OIMC), with

operational support from GAO's Seattle Regional Office, managed the test and its evaluation. The pilot test involved installing VTC equipment; applying it to a variety of uses (such as job conferences, training, and briefings); and assessing participants' comments.

A total of \$162,505 was expended by the AOC to support the pilot test. Of this amount, \$33,152 was for nonrecurring start-up consultation, training, and equipment and telecommunications installation costs. The remainder was for telecommunications service (\$39,632), VTC equipment lease (\$53,011), and contractor network management services (\$36,710). These costs are considerably higher than the "normal cost" of an ongoing VTC operation because short-term leases and dedicated telecommunications lines were required for the pilot test. Lower cost alternatives are now available; for example, the amended legislative branch Common Services Agreement provides equipment and telecommunications service at significantly lower cost. For a comparable 6-month service at the same utilization rate experienced in the pilot test, dial-up telecommunications service would now cost only \$13,800, and payments for lease/purchase of equivalent equipment would cost \$37,320.

Results in Brief

Test results indicate that VTC has great potential for helping GAO work more effectively and efficiently. During the March-July 1991 evaluation period, 87 VTC sessions were conducted between headquarters and Seattle, and almost 99 percent of the participant responses gave VTC a positive rating. VTC communication had many advantages over such alternatives as the telephone, mail, or delayed in-person meetings because it promoted early discussion and resolution of job issues. Summaries of other test results are as follows:

- VTC significantly increased the face-to-face participation of essential staff in critical assignment meetings, especially in the job design and report preparation phases. Moreover, junior-level participants, who would otherwise have been excluded from discussions because of travel constraints, also benefited from on-the-job training on how and why decisions are made.
- VTC meetings are very efficient. Participants reported that people came to the meetings well prepared and quickly reached decisions.
- VTC eliminated the need for 39 otherwise essential trips between headquarters and Seattle. By avoiding staff travel time on these trips, VTC permitted more productive use of 58.5 staff-days that would have been

consumed in travel. In addition, \$31,000 in travel expenses was avoided, permitting this money to be devoted to other priority travel.

- All congressional participants in VTC meetings with Seattle staff agreed that the meetings improved communications. In one case, VTC permitted more detailed information because all field staff took part in the briefing, which would normally have been limited to senior staff.
- VTC was useful in nonassignment-related functions. For example, GAO's Training Institute used it to effectively deliver two courses to the Seattle Regional Office and GAO saved about \$2,300 in travel expenses and 6 staff-days in travel time.
- GAO managers also found that VTC could be used for many human resource management and administrative functions. For example, two employment interviews were conducted, potentially saving \$1,200 in travel expenses and 4 staff-days in travel time.

GAO concludes that VTC contributed to the effectiveness and efficiency of its operations during the pilot test. Therefore, GAO will be requesting the Congress to authorize reprogramming of funds required to begin phased implementation of VTC in fiscal year 1992. During this period, GAO plans to install VTC facilities in three additional field offices on the West Coast. As the cost of VTC technology continues to decrease and GAO can further demonstrate its growing value and effectiveness, we will continue to assess which field offices are future candidates for VTC.

Project Scope and Methodology

To conduct the VTC pilot, test sites in Washington, D.C., and Seattle were equipped with identical VTC systems. These systems consisted of two cameras, two video monitors (one to see participants at the other location and a second to view data and graphics), a separate video camera stand to send graphics and printed material, microphones, and a codec to encode and decode the video signal for transmission over telephone lines. Other equipment was placed at the test sites to increase the capabilities of conference participants and to complement the VTC system. This equipment included personal computers at both sites linked with high-speed data transmission, additional equipment for making high resolution video presentations, a video recorder, and a fax machine for sending printed copies of materials.

To assess the contributions of VTC technology, the Seattle Regional Office was selected because it is typical of GAO's distant locations, which require high travel costs and substantial travel time. Seattle also has a technical

support staff knowledgeable in computer and electronics technology and experienced in implementing major technology projects.

The pilot test called for GAO to assess possible uses of VTC for three important purposes:

- Assignment-related applications: GAO assessed VTC's effect on travel time and expenses, frequency of interactions between headquarters and Seattle staffs, work processes and product development, and productivity.
- Administrative/human resource management tasks: GAO evaluated the extent to which VTC meetings were an effective way to discuss policy changes, budgets, human resource issues, and similar activities.
- Training activities: GAO identified appropriate training courses for VTC delivery and developed teaching methods to apply with VTC.

To provide overall guidance and direction, the Evaluation Subcommittee of GAO's Information Resources Management Steering Committee (composed mostly of line managers) independently reviewed the VTC evaluation plan and draft report.

Participants' reactions from each VTC location were gathered by using a data collection instrument that requested user demographics, the reasons for using VTC, and perceptions of its quality and benefits. In addition, several focus groups of a few participants were convened to determine what benefits, issues, problems, or concerns arose from using VTC. An additional focus group assessed equipment quality and usefulness and other issues related to the sessions (such as room setting, microphone and equipment placement, and lighting).

Scope of the Pilot Test

Of the 87 VTC sessions held during the evaluation period, almost half (43) were related to specific job assignments, including 4 sessions in which congressional staff members were briefed. Of the 40 ongoing jobs in the Seattle Regional Office during the evaluation period, 24 jobs had one or more VTC sessions. The remaining 16 jobs were either just starting or concluding. Most of the jobs that started during the evaluation period have since used VTC during their work. Other sessions, such as seven sessions for training development and delivery and four sessions for staff presentations, were designed to test other potential equipment uses. In all,

255 people attended one or more VTC sessions, and GAO received 436 evaluation responses.¹

Table 1 shows the distribution of responses by participant position and meeting purpose. Participants represented a broad range of grades, positions, and divisions.

Table 1: Distribution of Responses by Participant Position and Meeting Purpose

Participant position	Job related	Administration	Training	Special projects ^a	Other	Total
Band I	47	2	4	2	7	62
Band II	10	0	17	30	19	176
Band III	54	4	14	15	8	95
SES	20	1	6	17	4	48
Other GAO	10	8	0	12	5	43
Non-GAO	0	0	8	0	0	8
Congressional staff	4	0	0	0	0	4
Total	235	25	57	76	43	436

^aIncludes such meetings as DMTAG-TAG Task Force, VTC Evaluation Task Force, and OIMC Network Project.

VTC Received High Marks From Participants

Participant reaction for using VTC to conduct GAO meetings was overwhelmingly positive. (See table 2.) Almost 99 percent of the responses were positive, and most of these were "very" positive rather than "generally" positive. A few respondents were neutral, but no respondent gave a negative rating to using VTC.

Table 2: User Ratings of VTC for Conducting GAO Meetings

Rating	Staff location (percent)	
	Washington, D.C.	Seattle
Very positive	76	87
Generally positive	21	13
Neutral	3	0
Generally negative	0	0
Very negative	0	0
No basis to judge	0	0

¹The number of people who actually participated was greater than 255. However, no evaluations were distributed at three large sessions—two noon seminars with the Office of Counseling and Career Development and an Asian-Pacific Heritage meeting with an official from the Equal Employment Opportunity Commission in Washington, D.C.

Participants emphasized the value of face-to-face VTC contacts in reaching agreement at critical job points. These contacts proved essential to avoid rework and deliver timely and high-quality products. Timeliness improved because VTC fostered participation by key decisionmakers, who can devote a few hours to a critical job meeting but find it difficult to devote 2-3 days to travel to attend that meeting. Participants also reported that VTC allowed them to reach agreement sooner and with greater clarity than was possible by using telephones or exchanging drafts by mail or fax machines. While the telephone is an effective tool for one-to-one communication, it is not as effective when several people are involved. Often, participants in a telephone conference are unable to identify the speaker, engaged in side conversations with others in the room, or distracted or interrupted unbeknownst to the participants at the other location. VTC eliminates all these distractions; reactions can be seen, different opinions can be openly discussed, and resolutions can be more quickly obtained.

VTC Increased Participation in Critical Assignment Meetings

VTC greatly increased the number of face-to-face participants in key job meetings. Of the 235 responses from meetings on GAO assignments, 184 (78 percent) respondents indicated that without VTC they would not have been able to participate in face-to-face discussions. These respondents stated that time constraints and inadequate travel resources would have precluded their involvement in meetings, notwithstanding the value of their participation.

Increased Participation by All Position Levels

VTC was highly successful in increasing the involvement of all position levels to resolve job issues. (See table 3.) For example, the participation of senior managers increased threefold with access to VTC. Because of busy schedules, senior managers can usually afford a few hours for a meeting but often find it difficult to schedule transcontinental travel, which requires 3 days at a minimum. The increased opportunity for senior management's involvement is an important benefit because their participation is essential to keeping an assignment on track and responsive to the needs of congressional requesters.

Table 3: Increased Participation In Job Meetings by Position Level

Position level	Staff who would have participated without VTC	Additional staff who participated because of VTC	Total VTC participants
Senior managers	21	65	86
EICs/AMs ^a	12	40	52
Evaluators	5	45	50
Specialists	13	34	47

^aRefers to evaluators-in-charge and assignment managers.

Assignment teams said VTC gave them greater access to senior managers and specialists and therefore enhanced discussions and decision-making. For example, one VTC user said, "It was an opportunity for the director and the senior assistant director for the area to interact with our team in Seattle. [The team was] able to make their presentation [and] it enhanced the comfort level of the Seattle staff [because communication with the director and senior assistant confirmed they agreed with the report's message]."

Another VTC benefit was the ability to arrange meetings with the appropriate people very quickly and with limited advance notice. For example, respondents said VTC enabled them to involve such people as headquarters specialists at key job points. While specialists are often called upon to assist on assignments, they are not always available to attend a job meeting with other team members because of the multiple demands for their services. Furthermore, by offering many junior staff members the opportunity to participate in job meetings, VTC provided valuable on-the-job training.

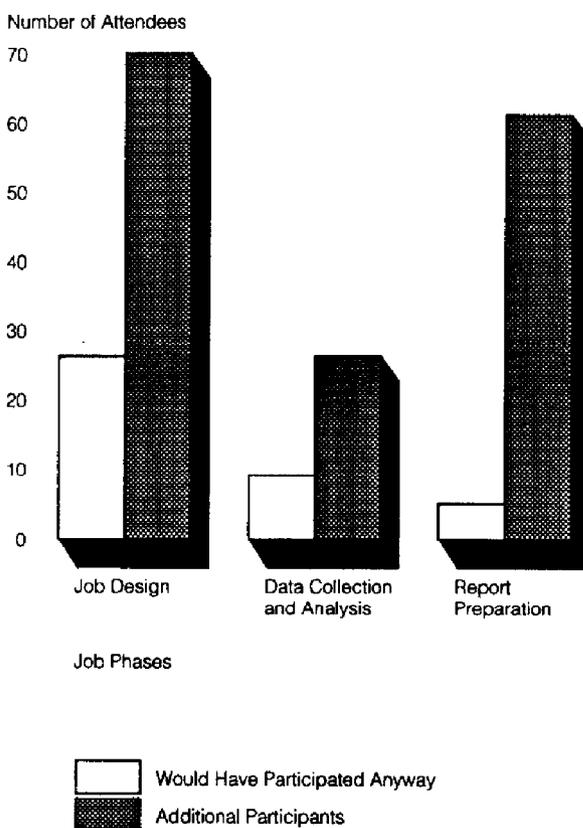
Increased Participation at All Job Phases

VTC increased participation at all job phases² (see fig. 1) and allowed face-to-face meetings at important times during the jobs. Of the 184 additional participants in face-to-face job discussions, 38 percent took part in job planning and scoping meetings. Communication between the team and senior management is important during this phase because the team must define the objectives, scope, and methodology; develop an acceptable job plan; and discuss these issues with the congressional requestor. The second job phase, data collection and analysis, had the smallest increase in conference participants because users thought these two activities did not lend themselves to using VTC. The final job phase,

²About 16 percent of the additional participants were part of job-related discussions that did not pertain to a job phase, such as a briefing after a job was completed.

report preparation, had 33 percent of the increased participants. Users said vtc enabled them to meet much sooner with senior managers and to agree on the report message, develop draft outlines, or review a draft product. By enabling team members to discuss different opinions face-to-face and agree on a report message more quickly, vtc can help reduce the number of report revisions.

Figure 1: Additional VTC Participants by Job Phase



VTC Reduced the Need for Trips, Increased Productivity, and Lowered Travel Costs

During the evaluation period, vtc eliminated the need for 39 trips between headquarters and Seattle by people who said they would have traveled to attend the meetings if vtc had not been available. By making many trips unnecessary, vtc technology benefited GAO in two important ways. First, the time currently spent traveling was put to more productive use. For example, each coast-to-coast trip consumes at least 1-1/2 days of travel time. By eliminating the need for 39 coast-to-coast trips, vtc added 58.5

days of productive staff time. Conference participants also commented that VTC meetings can be more productive than those held in person because people came to them more prepared and appeared to reach decisions more quickly.

A second benefit of fewer trips was reduced travel costs. GAO estimated that the 39 coast-to-coast trips would have cost \$31,000. By foregoing them, GAO units were able to use these funds for other priority travel.

VTC Improved Communication With the Congress

Although GAO's VTC pilot test included limited congressional interaction, it demonstrated potential for enhancing communication with the Congress. During the test, VTC was used to convene four face-to-face meetings between congressional and Seattle audit staffs. All congressional participants said these meetings were beneficial. Given the need for discussions between congressional and regional staff, VTC presents an effective means for GAO to establish and maintain direct communication.

For example, during one assignment that took 60 days to complete and involved 5 VTC sessions totaling nearly 9 hours, the job began with a VTC meeting between GAO headquarters and Seattle staff (who had never met face-to-face) and ended with a briefing for congressional staff. The VTC sessions included all the assignment's field staff and key headquarters staff (including staff from another GAO field office) and eliminated the need to have three, 3-day meetings where travel would have been required for at least two staff for each trip. On another assignment, congressional staff requested using VTC to enable all the Seattle staff who worked on a job to participate in briefing them. Without this technology, only senior staff could have traveled to Washington, D.C., to brief them.

VTC Provided New Training Opportunities

As part of the test, GAO offered three courses via VTC:

- The Information Management and Technology Division (IMTEC) presented a joint headquarters/Seattle training session on information resources management.
- Through a computer-to-computer link, the Training Institute trained staff from Seattle, Denver, and San Francisco to train their fellow employees to use WordPerfect 5.1. (GAO also saved considerable travel funds by providing this course to all three regions at the Seattle Office.)

- The Training Institute offered the Seattle staff the course, *Preparing Effective Presentations*, which was taught by an instructor in Washington.

Instructor and participant feedback on all three classes was positive. Training Institute management found that VTC training was an effective way to deliver instruction for those courses. Travel costs were saved by not having to send instructors to Seattle or participants to headquarters. VTC technology also had the advantage of providing more timely training to those who otherwise would have had to wait to schedule a class.

In addition to using VTC to provide courses, GAO found that junior staff received valuable on-the-job training by being able to participate in assignment meetings. GAO line managers noted that VTC not only allowed junior staff members to make substantive contributions but also helped them understand how and why management decisions are made. (Typically, only one senior team member travels to headquarters or to the regional office because of cost constraints.)

Pilot Test Revealed Other Uses of VTC

As GAO staff experimented with using the VTC equipment, they identified several new uses not initially planned. For example, because the microcomputers at each site were linked via the VTC telecommunications lines and operated with remote access software, staff found that VTC provided an effective and immediate way to review and change drafts between remote locations. Headquarters and Seattle staff could simultaneously revise drafts while discussing the changes over the VTC equipment. These face-to-face discussions expedited the review process by clarifying the need for changes while eliminating the need to send drafts back and forth or to travel between locations. On one job assignment, the team used this linked microcomputer capability to jointly draft a report in 2 consecutive days. Ordinarily, to accomplish the same objective, would have required at least a week trip for two Seattle staff to meet in Washington, D.C.

GAO staff also found several nonassignment-related uses for VTC. VTC proved to be an effective way to conduct final employment interviews for headquarters positions. While regional staff often conduct screening interviews with applicants, a headquarters employee usually flies to the region to conduct the final interview. With VTC, interviews could be arranged without travel delays, with the appropriate people, and with little

advance notice. Thus, VTC provided an inexpensive, effective, and far quicker interviewing approach.

VTC also provided an easier and quicker way to organize awards presentations and job recognitions. Instead of waiting for all participants to get together, formal presentations could be made via VTC. Also, sensitive personnel matters that required face-to-face contacts did not have to wait for travel by one of the participants. Once steps were taken to ensure privacy, feedback, counseling, and other personnel matters could be provided through VTC.

Pilot Test Showed VTC Has Some Limitations

GAO's pilot test demonstrated some limitations in VTC's effectiveness. For instance, some participants noted that VTC was less suited for certain types of activities (such as data collection) and that VTC worked better when participants already knew each other or had met in a previous videoconference. Participants also pointed out some problems, such as the inability to hear some speakers when the group at the other location was large.

One common participant observation was the initial fear of being on camera. However, most participants became more comfortable once the session started and were very positive about using VTC by the end of the session. (See table 2.) This suggests that first-time users would greatly benefit from a brief orientation prior to their first VTC meeting.

Limited Implementation of VTC Is Warranted Now

By improving communication between GAO teams and offices, VTC has shown its effectiveness in helping GAO meet its mission and achieve quality, timeliness, and productivity goals. Research and analysis during the pilot test indicate that now is an appropriate time in the life-cycle of developing VTC technology to begin limited implementation. Accordingly, GAO plans to begin phased implementation of VTC at headquarters and its West Coast offices in Los Angeles, Seattle, San Francisco, and Sacramento. Two headquarters divisions and San Francisco and Sacramento are also participating in GAO's pilot test of using computer networks to perform audits and evaluations. As a part of its Total Quality Management program, GAO will test how VTC and network technologies can best be integrated to assess the complementary and synergistic advantages of using both technologies to support its mission work. As technology evolves and cost

and operational considerations justify, GAO intends to gradually expand VTC service to other offices.

In developing VTC's implementation plan, GAO has determined that several technical issues were critical to future success and has addressed them in the following design decisions.

"Dial-up" Telecommunications Service Offers Advantages for Future Applications

GAO's pilot test was primarily limited to videoconferencing between headquarters and Seattle through a point-to-point, dedicated, high-capacity telephone/data line, which at that time was the only high-speed option available.³ Although this dedicated line is highly reliable and produces excellent video quality, it is expensive (\$9,480 a month for service between Washington, D.C., and Seattle). During the pilot, GAO also tested "dial-up" service on two low-capacity, standard, switched data lines.⁴ The operating advantage of switched service is that one can dial-up any VTC facility that has compatible VTC codec equipment and a public data line telephone number. Compared with higher bandwidths that use a dedicated line, this service provided a very low-cost operation but produced a video image and sound quality that usually left much to be desired.

Since the pilot test began, the legislative branch common services carrier has introduced a new service combining multiple dial-up switched data lines to yield the bandwidth required for desired picture quality. If such dial-up service had been available during the pilot test, telecommunications service would have cost about \$2,300 a month (compared with \$9,480 a month for the dedicated line). Thus, switched service not only is significantly less costly than a dedicated line but also offers the potential to hold high-quality videoconferences in the future between a broad array of additional participants, such as region with region; region with suboffice; and GAO with the Hill, federal agencies, and private organizations with compatible equipment. Therefore, GAO plans to use dial-up service for VTC in 1992 and further evaluate its reliability and the staffing cost required to operate it.

In addition, multipoint dial-up telecommunications service, which enables three or more locations to simultaneously participate in a conference, is likely to become available from the legislative branch common services

³The dedicated T-1 line has a bandwidth capacity of 1,544 kbs (thousand bits per second), which is four times the 384 kbs maximum capacity that GAO's VTC equipment was able to use.

⁴This service provides 56 kbs and yields a bandwidth of 112 kbs.

carrier in the near future. Therefore, GAO should obtain multipoint service if it becomes available and evaluate its benefits. For example, a headquarters instructor could train the staff of several regional offices and/or suboffices simultaneously, or multiple field offices could all participate in assignment conferences.

**Compatible VTC
Equipment Offers
Significant Future
Opportunities**

VTC will be vastly enriched when more extensive intercarrier telecommunications switching becomes available, when a comprehensive international VTC telecommunications standard is established, and when VTC vendors offer codecs that operate within this standard. The video portion of this standard has already been adopted, and codecs operating within it are now available. In the next few years, a comprehensive standard including such features as graphics and voice will likely be adopted internationally. GAO is also participating in a legislative branch task force formed to recommend a legislative branch VTC standard.

GAO plans to acquire VTC equipment that can operate on the new video standard and can be upgraded to meet future standards. During fiscal year 1992, GAO will actively experiment with VTC compatibility to develop firsthand knowledge of technical and quality issues and to understand the cost and benefits of using VTC's evolving technology. By acquiring this knowledge, GAO will be able to effectively plan the best future use of VTC technology in fulfilling its mission.

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